Infragravity waves and sea level

(and « usual waves », roughness, SSB ...)

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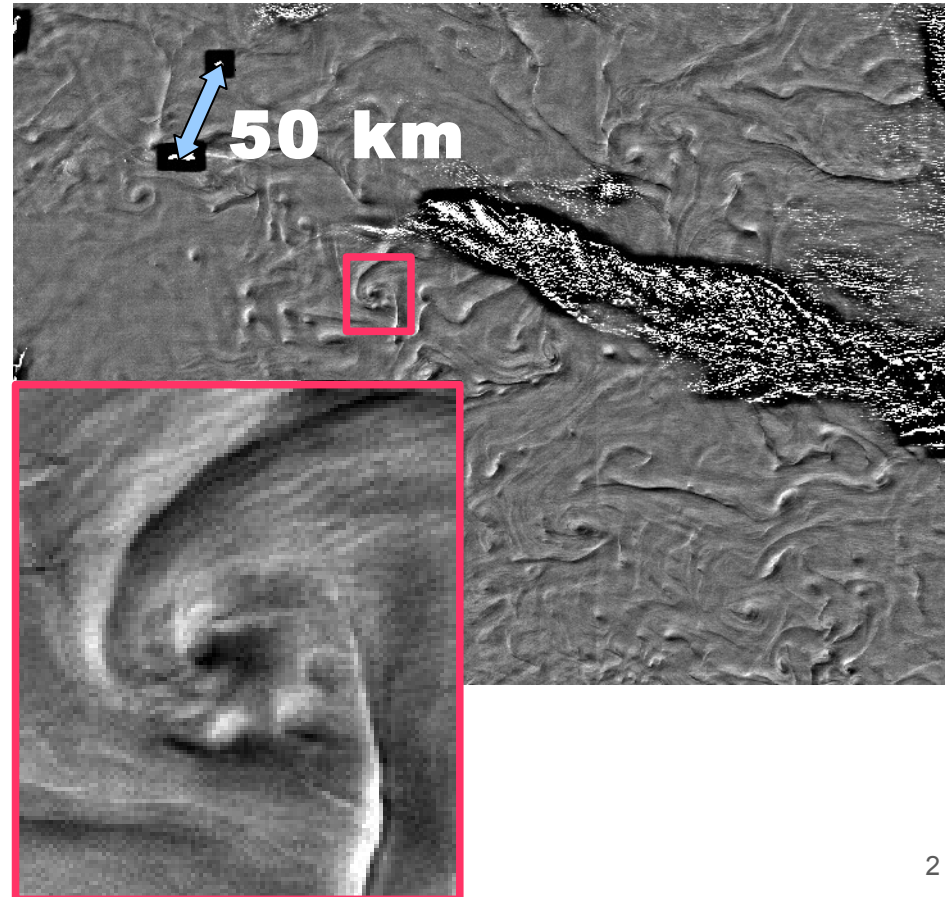
1) The big picture

Atmosphere and oceans interact through waves

Waves define the surface roughness

SWOT will measure altimetry + roughness

Can we understand roughness ?

does it have a dynamical effect

on the submesoscale evolution ?

50 km

2) Specific objectives

One overlooked aspect of high-resolution altimetry are the surface gravity waves with 5 – 50 km wavelength. These are mostly generated at shorelines by shorter ocean waves.

The average height of these « infragravity waves » is of the order of 4 to 8 mm, and can exceed 4 cm during storms.

If the target accuracy at 10 km wavelength is **1 cm^2/ (cyc / km)** then IG waves account for that **10% of the time** off the U.S. West Coast. And **0.1 cm^2/ (cyc / km)** is exceeded and **80% of the time**.
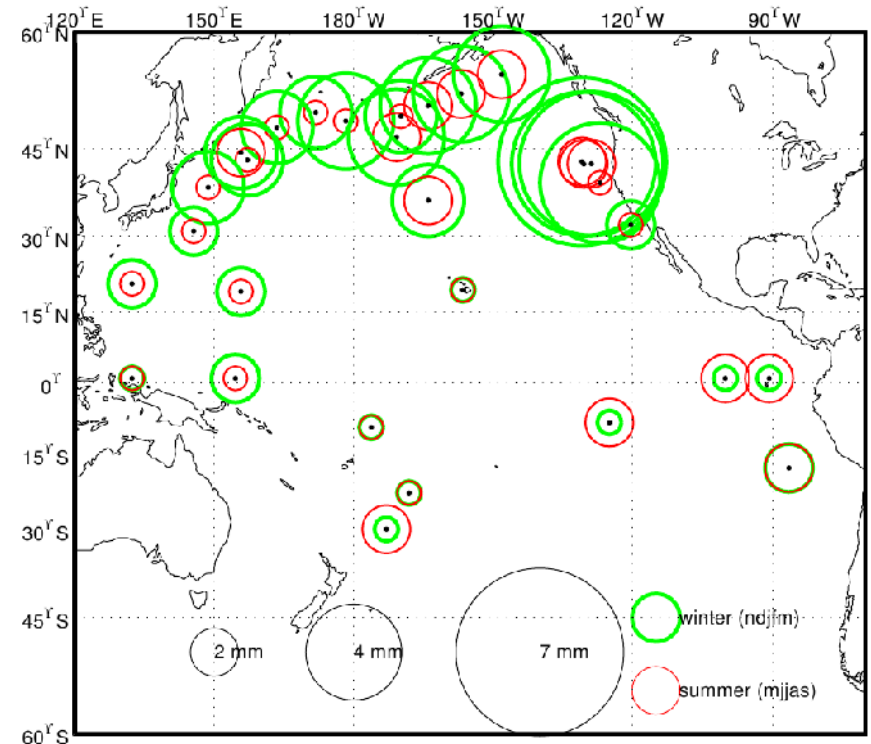
Another question is :
Can we model and understand high resolution roughness (mss) ?
(e.g. Kudryavtsev et al. JGR 2012)

3) Phase-A SWOT issues

Are the current error budgets realistic?

From our preliminary analysis IG waves will often be a large source of error if the target is 1 cm^2 / (cyc / km) at L=10 km wavelengths, especially off west coasts. These error probably do not matter anymore for L > 30 km.

requirements for high-resolution data

- shorter but higher swell waves typically give a standard error of the order 2 mm on the mean sea level averaged over a 10 km by 10 km square.

- roughness modulation on swell scales may cause some non-trivial correlation with the orbital velocities and thus a phase shift in the measured KaRIN signal

- Combining roughness and elevation will be critical for estimating currents at the highest resolutions.

For all these reasons there is a need for understanding the signal at sub-pixel resolutions over the oceans.